CHAPTER 14

AIRCRAFT REFUELING EQUIPMENT

FORWARD

In aircraft refueling operations, equipment and policy are interrelated. The two basic types of refueling systems, closed-circuit and open-port, are presented in this chapter, as is the policy for their use. Hose requirements are also given. The 500-gallon collapsible drum, which can be used with the FARE but is not an end-item component, is also discussed. The type of nozzle used influences the safety of the operation and therefore refueling policy. Nozzles and hoses are equipment elements that are common to all refueling operations whether refueling service is supplied by a FARE system, a larger temporary system, or a refueler.

CLOSED-CIRCUIT REFUELING

Closed-circuit refueling is a system of refueling in which the nozzle mates with and locks into the fuel tank. This eliminates spillage. Any closed system of aircraft refueling depends on two basic pieces of equipment--a receiver that is mounted in the aircraft and a nozzle. These two pieces of equipment are designed for each other. They mate or lock together before fuel can flow through them. The Army has two equipment systems. They are the CCR system that is part of the FARE system and the D-1 pressure system (also called the centerpoint system). Its components, except for the receiver, are mounted on the M970 semitrailer. The CCR system is described below.

CCR Fill Port

The CCR fill port as shown in Figure 14-1, page 14-2, is built into the aircraft. It includes a float-operated valve that controls the flow of fuel into the aircraft tank or tanks. The valve is set to close at a certain level. It shuts off the flow automatically if the rate of fuel flow exceeds the aircraft's maximum safe flow rate. The device in the receiver that mates to the CCR nozzle is recessed several inches inside the receiver. A bypass opening, covered by a sliding panel, is positioned inside the receiver in the space between the outside dust plug and the mating device. When the sliding panel over this bypass is pushed aside, it is possible to refuel an aircraft that has a CCR receiver with a conventional automotive-type nozzle. A variation is a CCR receiver mounted on a hinged panel that swings inward when unlatched to allow access for open-port refueling. This procedure, though not desirable, is used during changeover from closed- to open-circuit refueling.

CCR Nozzle

There are currently four models of CCR nozzles in the Aviation community. They are the Wiggins, Aeroquip, Tube Alloy, and J.C. Carter. All four have a cam-lock coupler. A unisex coupler, model 125-0505, is available for use with the HTARS. The CCR nozzle as shown in Figure 14-2, page 14-3, mates the fuel supply line to the CCR fill port as shown in Figure 14-3, page 14-3. When the nozzle drybreak coupling is coupled onto the port's receiving nipple, it locks the two parts together mechanically. The two parts stay latched together until they are opened by a pull on the latch release (a lanyard on the Wiggins model and a handle on the newer models). A valve in the CCR nozzle keeps the nozzle closed so that fuel cannot flow unless the nozzle is mated to the port, even if the flow control handle is accidentally moved into the FLOW position. The same valve will shut off the flow of fuel if, for some reason, the nozzle is unlatched from the fill port before the flow control handle is moved to the NO FLOW position. The CCR nozzle can be operated at flow rates up to 150 GPM. Its pressure regulator limits the pressure, at the point of connection to the fill port, to 15 PSI. The nozzle has a strainer assembly (100-mesh, wire cloth strainer) set between the nozzle inlet and the nozzle coupling. These assemblies unscrew so that the strainer can be taken out to be cleaned. The nozzle is equipped with both a bonding plug and grounding clip.

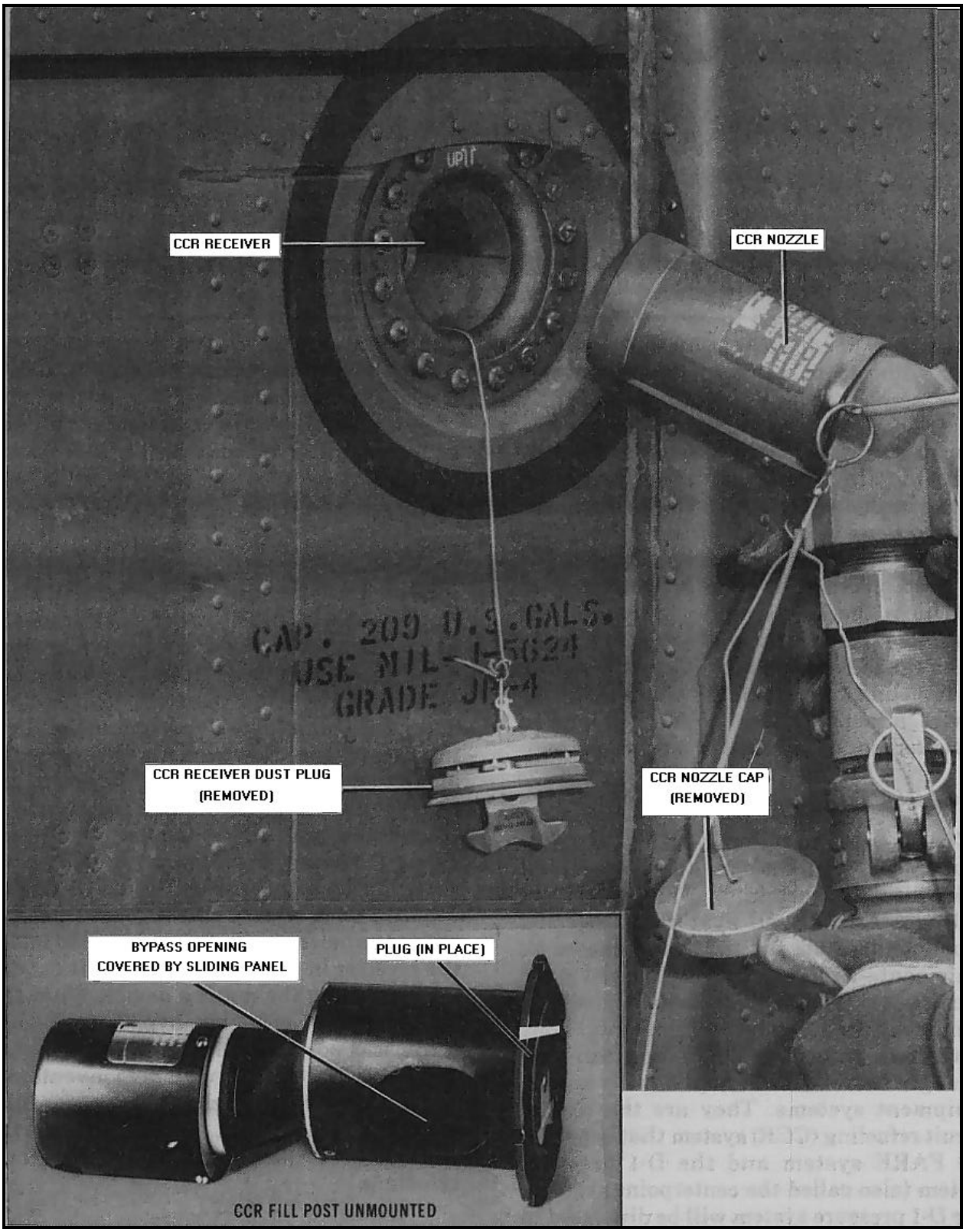

Figure 14-1. CCR fill port components

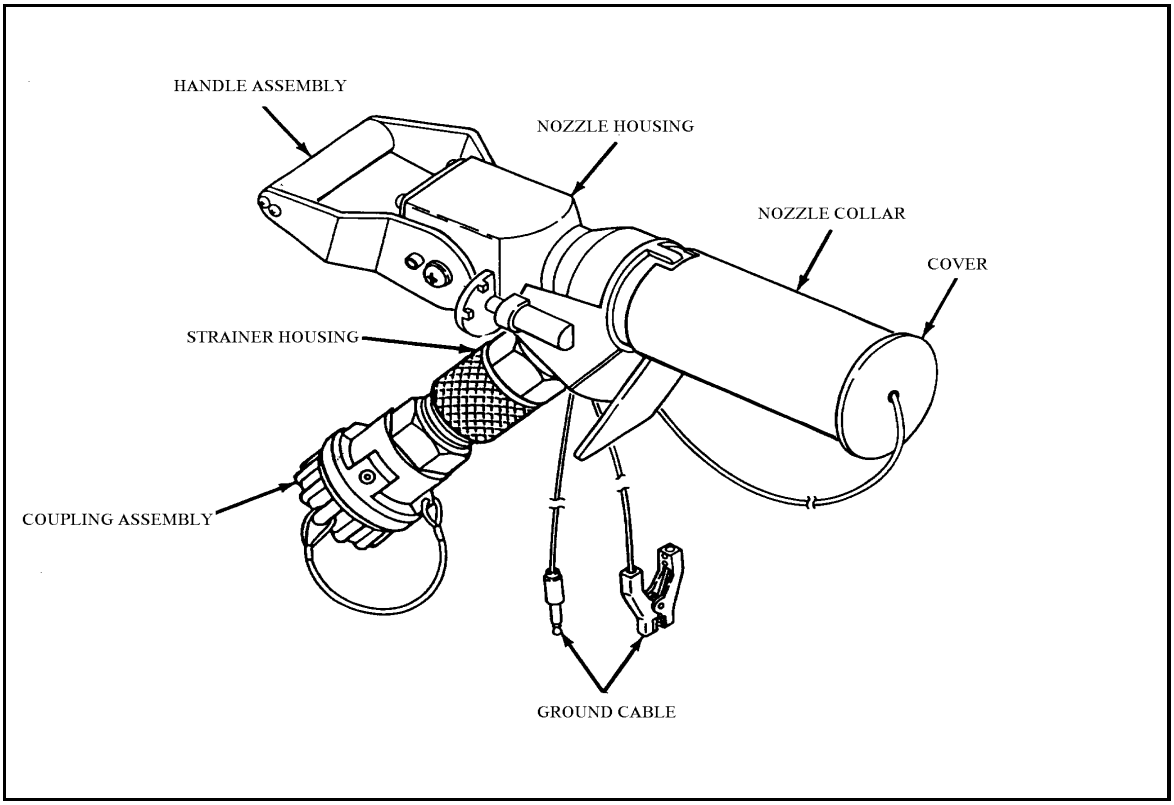

Figure 14-2. CCR nozzle

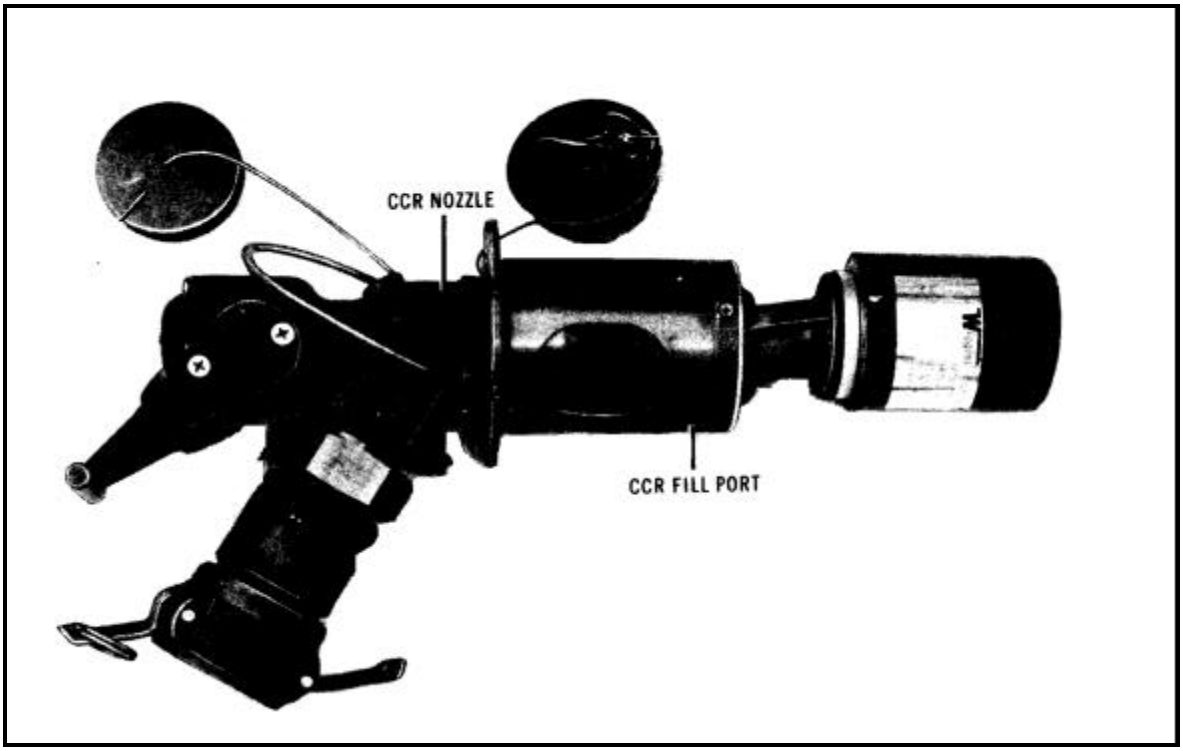

Figure 14-3. CCR nozzle mated to CCR fill port

Open-Port (Gravity-Fill) Nozzle Adapter

An open-port nozzle adapter as shown in Figure 14-4, changes the CCR nozzle making it possible to service an aircraft using the open-port refueling method. The nozzle adapter is used when the aircraft is not adapted to CCR or when the CCR receptacle is damaged; the adapter is not used in closed-circuit refueling. The open-port nozzle adapter is like the conventional nozzle used to refuel vehicles. It has its own dust cap. It locks into the discharge end of the CCR nozzle as shown in Figure 14-5, so that the CCR system can be used to fuel aircraft with conventional fill ports. A squeeze-type, trigger grip opens and shuts the flow control valve of the adapter, but the flow control valve of the CCR nozzle itself must be open before fuel can flow. The adapter, like any conventional nozzle, must not be modified with a device that locks the trigger open. If such a locking device has been added, it must be removed. The adapter must be held and operated by hand during refueling. The nozzle adapter can be used if, in unusual circumstances, it is necessary to bypass the CCR system. Example: if a CCR receiver malfunctions, the CCR nozzle will not mate to it properly and it will not be possible to pump fuel through the CCR system. In such cases, the adapter can be mated to the CCR nozzle and used to pump fuel through the bypass in the receiver as shown in Figure 14-6, page 14-5.

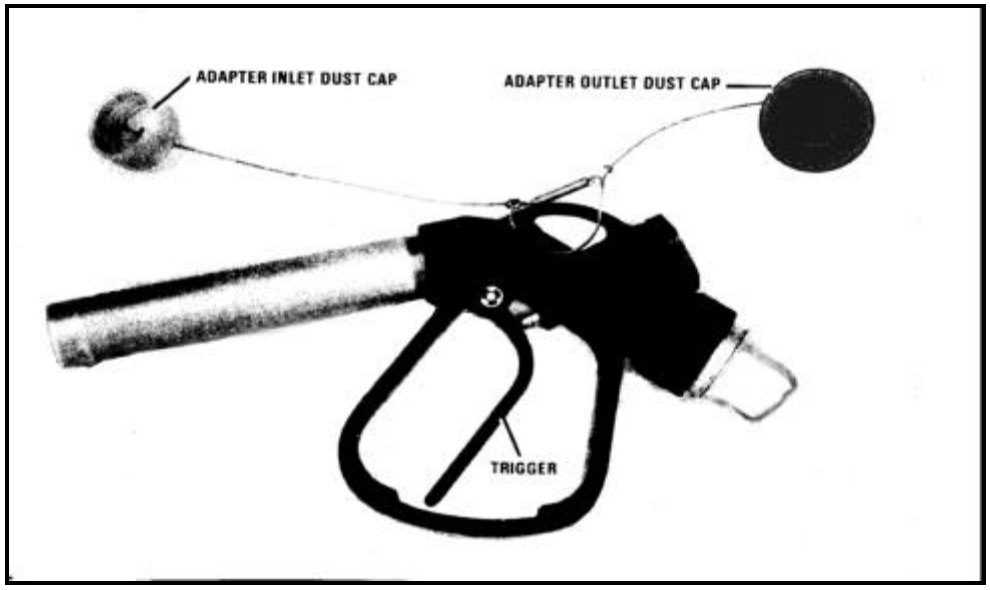

Figure 14-4. CCR open-port (gravity-fill) nozzle adapter

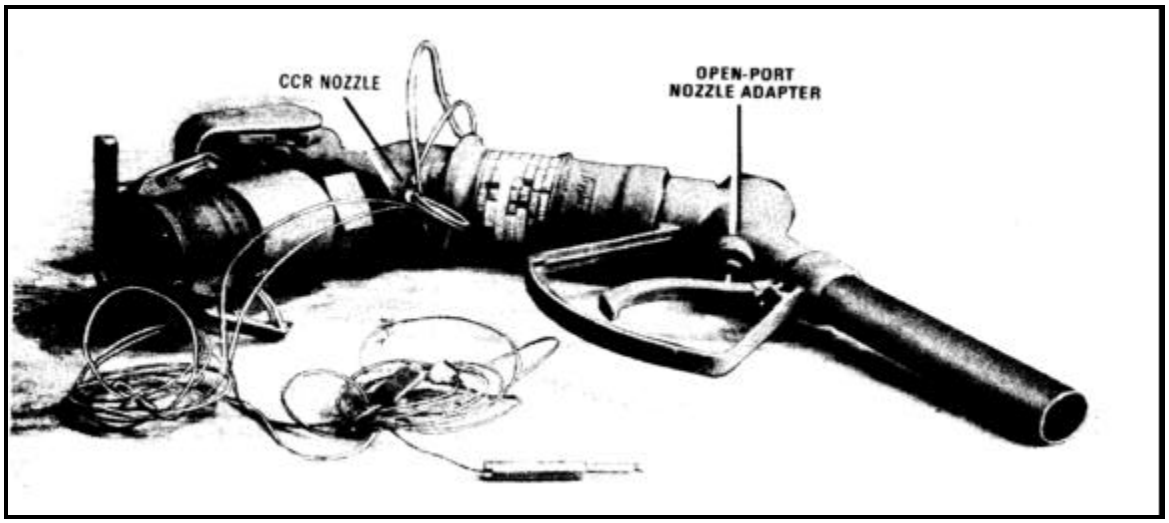

Figure 14-5. CCR open-port (gravity-fill) nozzle adapter mated to the CCR nozzle

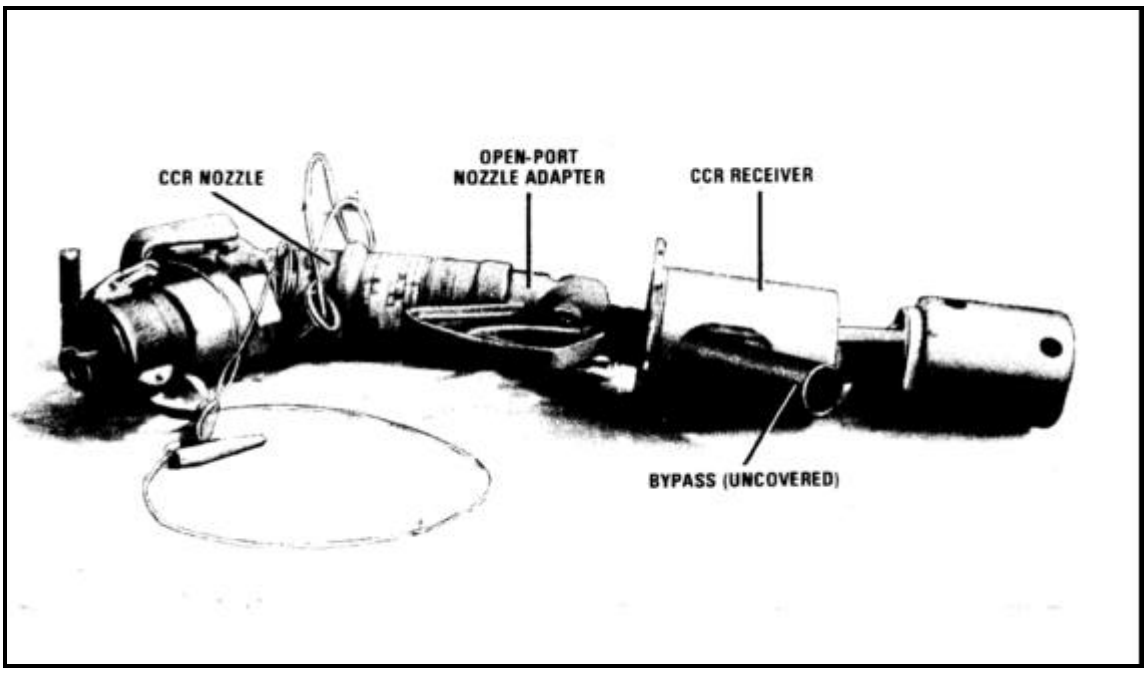

Figure 14-6. CCR open-port nozzle adapter positioned through bypass in the CCR fill port

Closed-Circuit Equipment Use

Use of closed-circuit equipment is especially desirable when aircraft are being serviced by the rapid-refueling method. Rapid refueling is used to reduce the ground time needed to refuel aircraft, particularly helicopters used in support of combat operations. Reducing ground time does two things. First, it reduces the amount of time that the aircraft is a stationary target. Second, it cuts the time that ground forces are without air support. In spite of its major advantage in a tactical situation, rapid refueling is less safe than refueling with the engines shut down. Closed-circuit equipment is preferred because of its builtin safety features. CCR prevents spills; prevents fuel vapors from escaping at the aircraft fill port; and prevents dirt, water, and other contaminants from entering the aircraft fuel supply during refueling. These factors contribute to safe ground operations by reducing the fire hazard and safe flight operations by protecting the quality of the fuel used.

OPEN-PORT REFUELING

Open-port refueling is refueling by inserting an automotive-type nozzle into a fill port of a larger diameter. Most of the Army's fueling nozzles are designed for open-port refueling. Because the port is larger than the nozzle, fuel vapors can escape through the fill port during open-port refueling operations. Airborne dust and dirt, as well as rain, snow, and ice, can get into the fill port during refueling. This contamination lowers the quality of the fuel in the tanks and endangers the aircraft. Spills from overflowing tanks are possible in open-port refueling. Spills can be caused from the sudden power surge that occurs when another nozzle in the system stops pumping. This throws the whole push of the pump to the operating nozzle. Because of these dangers, rapid refueling by the open-port method is restricted to combat, vital training, or testing use.

Open-Port Nozzles

The Army has standard 1-inch, 1 1/2-inch, and 2 1/2-inch, automotive-type nozzles that are used in aircraft refueling. The standard Army overwing nozzle is an open-port nozzle. It is equipped with a ring shaped bumper that prevents it from going too far into the fill port mounted in the wing of a fixed-wing aircraft. This bumper can be removed. Then, the nozzle can be used like an automotive type nozzle to fuel an aircraft equipped with a fill port on the side of the fuselage. The CCR nozzle adapter also is used as an open-port nozzle. Although all these nozzles, with the exception of the CCR adapter, are shown as equipment of refueling vehicles, any can be used

with a hose, filter/separator, pumping assembly, and fuel source to form a small, temporary aircraft refueling system.

Open-Port Nozzle Use

No Army, open-port nozzle may be equipped to stay open automatically. Open-port nozzles must be held open by hand throughout their use in refueling. If any automatic device has been added to the nozzle to hold it open, the device must be removed.

REFUELING POLICY

Except as indicated below, an aircraft may not be refueled with its engines operating. The engines must be shut down before refueling begins. The exceptions are described below.

- Closed-Circuit Rapid Refueling. All Army aircraft may be refueled with engines running provided that closed-circuit equipment is used.
- Open-Port Rapid Refueling. In combat operations, the open-port method of rapid refueling may be used for helicopters when, in the judgment of the aviation commander, the requirements of the tactical mission and the benefits of reducing ground time outweigh the risks of this method of refueling. In noncombat situations, helicopters may be refueled by this method only when there are compelling reasons to do so. Example: Aviation commanders may decide that open-port rapid refueling must be done for purposes of training, field testing, or combat testing. When the FARE system is used for rapid refueling in a training situation, a berm should be built around the 500-gallon drums whenever possible.

AIRCRAFT REFUELING HOSE

Hose used for aircraft refueling operations must be in good condition. Hose should be inspected before use. If bulges, blisters, tears, or soft spots are noticed, replace the hose. If during normal operations the hose leaks or bulges, discontinue operations and replace the hose immediately. Hydrostatic testing of hose, other than sea hose and cargo hose, is not required. However, testing can be performed on all hoses.

Testing

To perform hydrostatic test procedures, specialized equipment is needed. This equipment is normally found at maintenance facilities. The maintenance facility can perform the test procedures when the hose is uncoupled from the vehicle. Operators are not expected to follow the procedures described below in a tactical or field situation:

- Use a liquid for the test that will not damage the hose or contaminate aviation fuel when the hose is returned to service. Use a liquid such as water, mineral spirits, solvent, or a kerosene-type aviation fuel. Do not use JP-4 or blends of kerosene and gasoline. Whatever liquid used, handle it according to applicable handling procedures.
- Connect one end of the hose to a cap equipped with an air bleeder valve that can produce enough pressure for the test. Lay out the hose in a straight line, and remove all kinks and twists. Make sure all connections are tight.
- Open the air bleeder valve, and pump liquid into the hose while holding the capped end up. Close the bleeder valve when the hose is full of liquid and all air is removed. All air is removed when a solid stream of liquid comes out of the bleeder valve.

Raise the pressure in the hose to the required level and maintain it for at least one minute. Check the hose for leaks. If a leak is located at a place other than a hose coupling juncture, release the pressure in the hose and tighten the coupling. Then bring the pressure back up to the required level, and hold it again for at least one minute. Replace or repair the hose if a coupling leaks, bulges, or has distortions in it.

Salvage and Recoupling

Hose that has been removed from service because it failed when tested or is damaged may be repaired and returned to use after testing. If part of the hose is in good condition and is long enough, cut off the damaged part and replace the coupling. Be sure that all the damaged portion is removed, including any part that shows signs of carcass saturation. If the hose leaks at the coupling juncture, cut off at least the portion that is inserted into the coupling. Test the recoupled hose at its operating pressure. Lengths of suction hose that are in good condition but too short to justify recoupling may be saved and prepared for use in defueling.

THE 500 GALLON COLLAPSIBLE DRUM

The 500-gallon collapsible drum as shown in Figure 14-7, page 14-8, is a durable, nonvented collapsible container. It may be used as a fuel source or for transporting and storage of fuel. When filled to its 500 gallon capacity, the drum is cylindrical in shape with rounded ends. The drum fabric is impregnated with fuel-resistant synthetic rubber. The front and rear closure plates are connected by three wire ropes providing interior support. The front closure plate has a threaded coupler valve assembly. Newer models have a threaded coupler valve on both the front and rear closure plates. Procedures for filling, transporting, and storing the drum are described below.

Filling the 500-Gallon Collapsible Drum

Use the pressure control valve to fill the 500-gallon collapsible drum. The pressure control valve should be used when drums are filled to prevent overfilling that could result in personal injury, equipment damage, and environmental damage. To fill drums with the pressure control valve, perform the following:

- Place empty drums in position for helicopter pickup.
- Move a spill container to the drum being filled first.
- Pull the tank vehicle within 50 feet of the drums.
- Ground the tank vehicle.
- Put a fire extinguisher within reach of the operation.
- Unreel the hose and remove the nozzle if applicable.
- Connect the hose to the inlet of the pressure control valve using necessary adapters.
- Connect the outlet end of the 1 1/2-inch pressure control valve to one end of a length of discharge hose and then couple the other end of the hose to the elbow coupler valve.
- Hold the elbow coupler valve over the spill container, and open the valve enough to let air out. Push the FILL button on the pressure control valve. As soon as the air is pushed out and the fuel flows, close the elbow valve.
- Couple the elbow to the drum, and open the elbow valve.
- Push the FILL button on the elbow valve, and fill the drum. The pressure control valve will shut off the flow when the drum is full.
- Close the elbow valve when the drum is full, and disconnect the elbow.
- Move to the next drum. Repeat the previous three steps until all drums are filled.

Transporting the 500-Gallon Collapsible Drum

The drum can be transported by three primary methods using accessory items. It can be airlifted using sling loading equipment. It can be transported by cargo vehicle using the tie-down kit. Also, it can be transported for short distances over smooth terrain, at speeds not exceeding 10 mph, using the towing and lifting yoke.

Storing the Collapsible Drum

Drums should be stored full of fuel. Too much collapsing and expanding of the drum takes its toll on the fabric. This is especially true during cold weather when the drum can become brittle and crack. In hot weather, fuel will expand. Always drain a small amount of fuel from the drums before storage to keep pressure down in hot weather climates. If local fire regulations prevent the storage of drums full of fuel, they should be completely drained. Never fill the drums with air. There is always some fuel left inside after the drums have been drained. Vapors inside the drums can cause an explosion.

•Store the drums indoors if possible. Use a dark, cool, well ventilated area with a smooth surface. Store the drums away from any source of heat that could damage the fabric or start a fire. Never stack the drums on top of each other or place equipment on top of them. That causes the fabric to wear and crack.

•If drums must be stored outdoors, keep them out of direct sunlight. The sun can cause the fabric to dry out and crack. Place the drums in a tent or under a tarp to block the sun and keep snow or ice off during cold weather. Keep the canvas propped up so air can circulate. If no shelter is available in hot climates, cover the drums with wet burlap or other cloth.

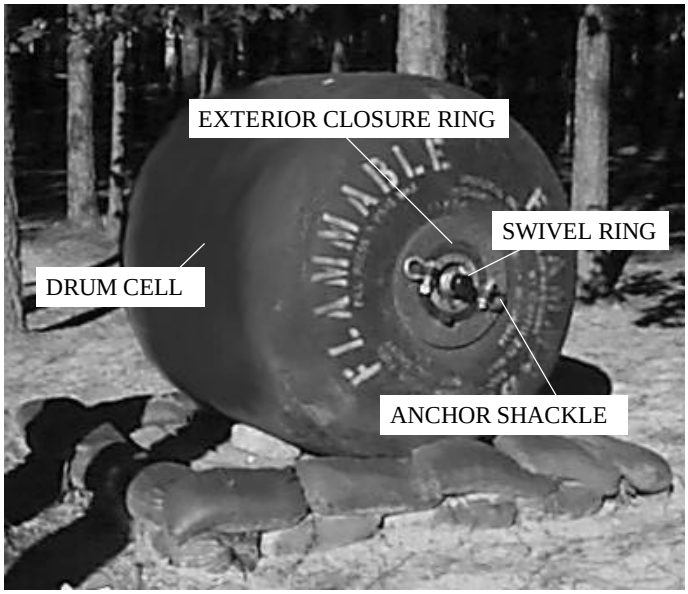

Figure 14-7. Filled 500-gallon drum